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SAMSUNG ELECTRONICS

Product Information

Customer : **DATE : 22.Nov.2005**

SAMSUNG TFT-LCD

MODEL : **LTA400HS-L01**

Any Modification of Specification is not allowed without SEC's Permission.

NOTE :

Customer's *Approval*	
SIGNATURE	DATE

APPROVAED BY	DATE
Kyunghwan Ko	22.Nov.2005
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LCD Application Engineering 3, TCS Team

Samsung Electronics Co . , LTD.

wise view™ SAMSUNG TFT-LCD

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* Revision History

Date	Rev. No	Page	Summary
Nov 22, 2005	000	all	First issued

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General Description

Description

LTA400HS-L01 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 40.0“ is 1920 x 1080 and this model can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV, Display terminals for AV application products, and High Definition TV (HDTV).

Features

RoHS compliance (Pb-free)

- High contrast ratio, high aperture ratio, fast response time
- SPVA(Super Patterned Vertical Align) mode
- Wide viewing angle (±178°)
- High speed response
- Wide UXGA (1920 x 1080 pixels) resolution (16:9)
- Low Power consumption
- Direct Type 22 CCFTs(Cold Cathode Fluorescent Tube)
- DE(Data Enable) mode
- LVDS (Low Voltage Differential Signaling) interface (2pixel/clock)

General Information

Items	Specification	Unit	Note
Module Size	952.0(H_{TYP}) x 551.0(V_{TYP}) 54.5(D_{MAX})	mm	±1.0mm
Weight	13,000(Max.)	g	
Pixel Pitch	0.46125(H) x 0.15375(W)*3	mm	
Active Display Area	885.6(H) x 498.15(V)	mm	
Surface Treatment	Haze 44% , Hard-coating (3H)		
Display Colors	8 bit - 16.7M	colors	
Number of Pixels	1920 x 1080	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally Black		
Luminance of White	500 (Typ.)	cd/㎡	

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1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item		Symbol	Min.	Max.	Unit	Note
Power Supply Voltage		V_{DD}	GND-0.5	*5.5*	V	(1)
Storage temperature		T_{STG}	-20	60	℃	(2)
Glass surface temperature (Operation)	Center	T_{OPR}	0	50	℃	(2),(5)
	T. Uniformity	△T	-	10	℃	
Shock (non - operating)		S_{nop}	-	50	G	(3)
Vibration (non - operating)		V_{nop}	-	1.5	G	(4)

Note (1) Ta= 25 ± 2 °C

(2) Temperature and relative humidity range are shown in the figure below.

a. 90 % RH Max. (Ta ≤ 39 °C)

b. Maximum wet-bulb temperature at 39 °C or less. (Ta ≤ 39 °C)

c. No condensation

(3) 11ms, sine wave, one time for ±X, ±Y, ±Z axis

(4) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

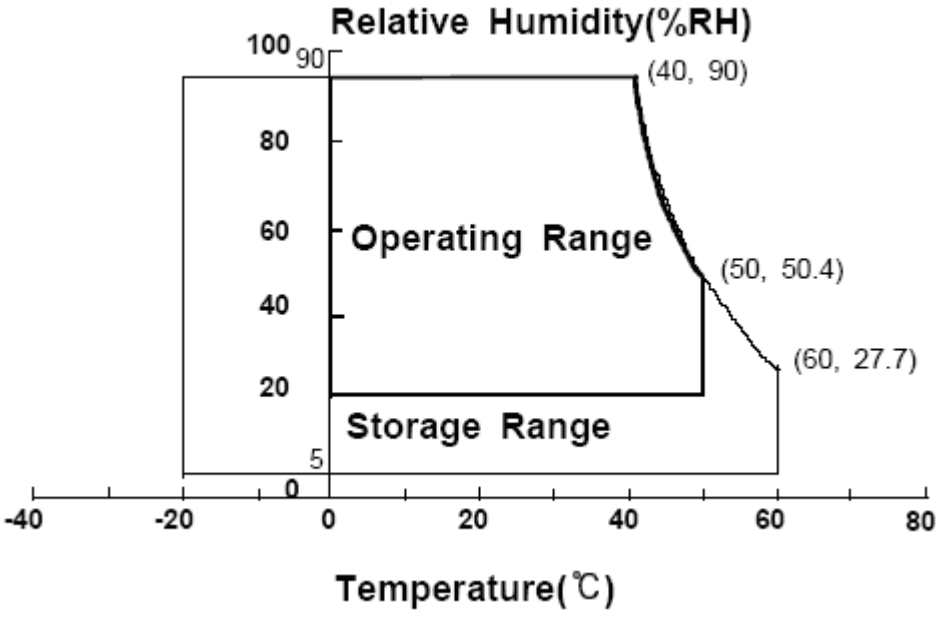
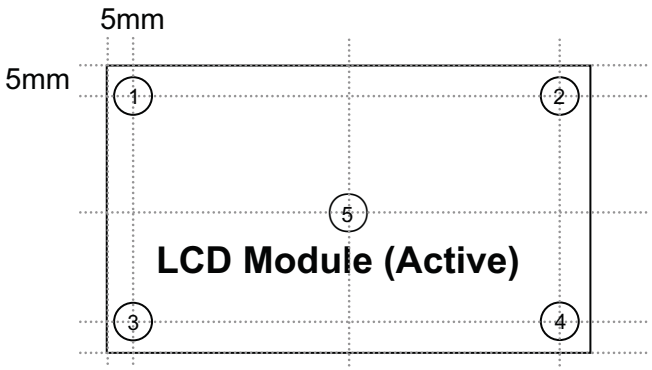


Fig. Temperature and Relative humidity range

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(5) Definition of test point



△T should be less than *10* ℃ (△T = | T_{OPR} – T_{MAX}|)

T_{OPR} : Temperature of the center of the glass surface (Test point 5)
T1~ T4 : Temperature of each edge of the glass surface
T_{MAX} : The highest temperature of the glass surface

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2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON BM-7,SPECTRORADIOMETER SR-3

(Ta = 25 ± 2°C, VDD=5V, fv= 60Hz, f_{DCLK}=74.25MHz, I_L = 6.0mArms)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R	Normal θL,R=0 θU,D=0 Viewing Angle	700	1000	-		(3) SR-3
Response Time	Rising	Tr		-	10	13	Msec	(5) BM-7
	Falling	Tf		-	6	7		
Luminance of White (Center of screen)		Y_L		400	500	-	cd/m²	(6) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.648	TYP. +0.03		(7),(8) SR-3
		Ry			0.331			
	Green	Gx			0.281			
		Gy			0.598			
	Blue	Bx			0.144			
		By			0.062			
	White	Wx			0.280			
		Wy			0.290			
Color Gamut		-		-	72	-	%	(7) SR-3
Color Temperature		T		-	10000	-	K	(7) SR-3
Viewing Angle	Hor.	θ_L	C/R≥10	75	89	-	Degree	(8) SR-3
		θ_R		75	89	-		
	Ver.	θ_U		75	89	-		
		θ_D		75	89	-		
Brightness Uniformity (9 Points)		B_{uni}		-	-	25	%	(4) SR-3

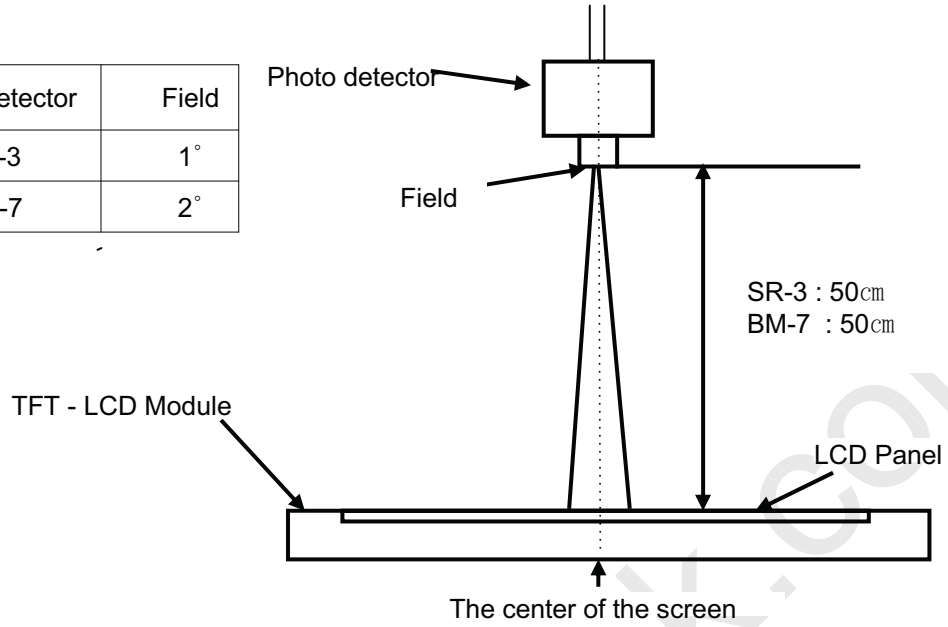
Note (1) Test Equipment Setup

The measurement should be executed in a stable, windless and dark room between 40min and 60min after lighting the back light at the given temperature for stabilization of the back light. This should be measured in the center of screen.

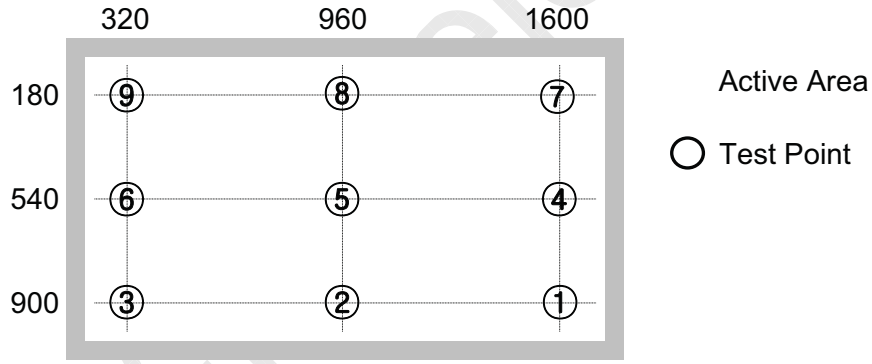
Single lamp current : 6.0mA
Environment condition : Ta = 25 ± 2 °C

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Photo detector	Field
SR-3	1°
BM-7	2°



Note (2) Definition of test point



Note (3) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

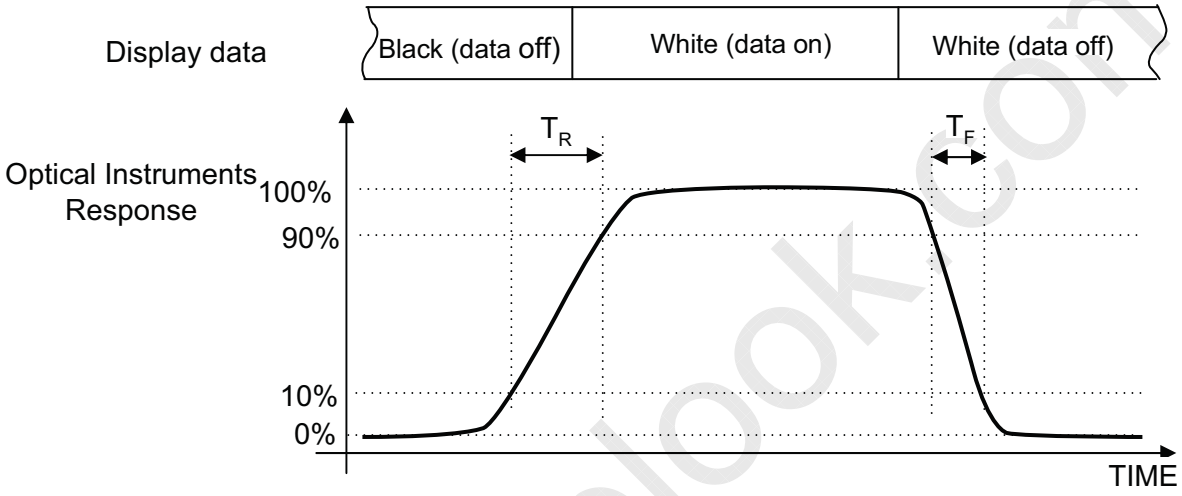
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Note (4) Definition of 9 points brightness uniformity

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

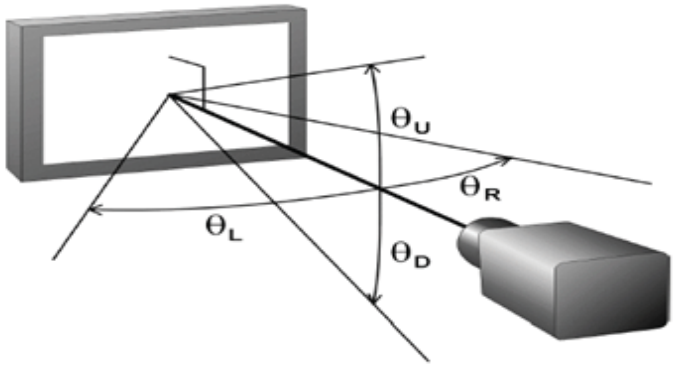
Note (5) Definition of Response time : Sum of Tr, Tf



Note (6) Definition of Luminance of White : Luminance of white at center point ⑤

Note (7) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red, Green, Blue & White at center point ⑤

Note (8) Definition of Viewing Angle
: Viewing angle range (C/R ≥10)



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3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C ± 2 °C

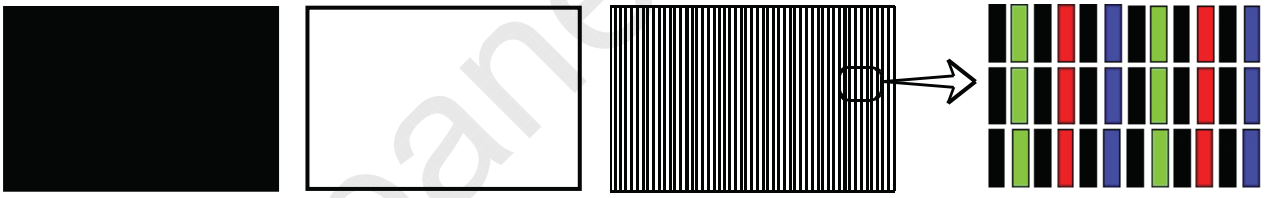
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	4.5	5.0	5.5	V	(1)
Current of Power Supply	(a) Black	I_{DD}	-	1800	-	mA	(2),(3)
	(b) White		-	2400	-	mA	
	(c) N-Pattern		-	2900	3100	mA	
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	48	67.5	-	kHz	
Main Frequency		f_{DCLK}	60	74.25	80	MHz	
Rush Current		I_{RUSH}	-	-	TBD	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

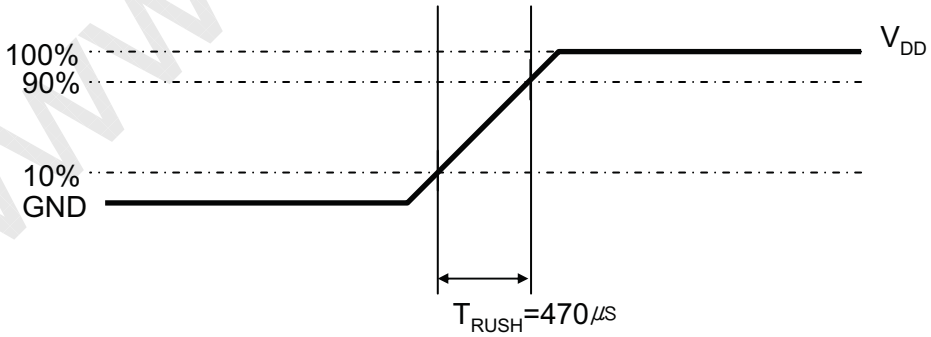
(2) fv=60Hz, f_{DCLK} = 74.25MHz, V_{DD} = 5.0V, DC Current.

(3) Power dissipation check pattern (LCD Module only)

a) Black Pattern b) White Pattern c) N-Pattern



(4) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH}. is 470㎲.

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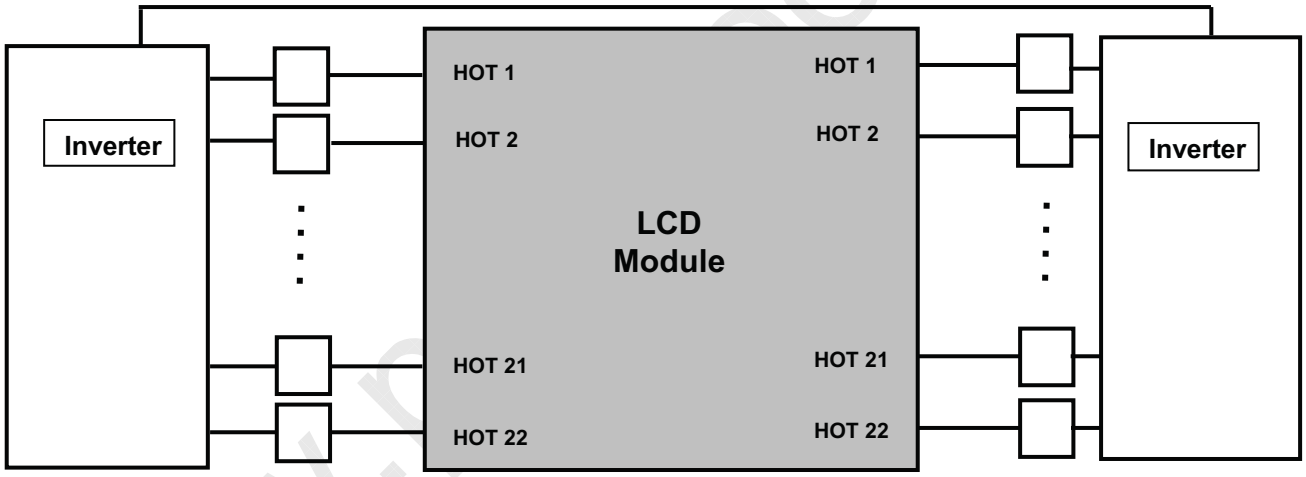
3.2 Back Light Unit

The back light unit contains 22 direct-lighting type CCFTs (Cold Cathode Fluorescent Tube). The characteristics of lamps are shown in the following tables.

Ta=25 ± 2°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Current	I_L	4.0	6.0	7.0	mArms	
Lamp Voltage	V_L	-	1540	-	Vrms	
Operating Life Time	Hr	50,000	-	-	Hour	(1)

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.
[Operating condition : Ta = 25±2℃, IL = 6.0mArms(typ.), For single lamp only.]



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3.3 Inverter Input Condition & Specification

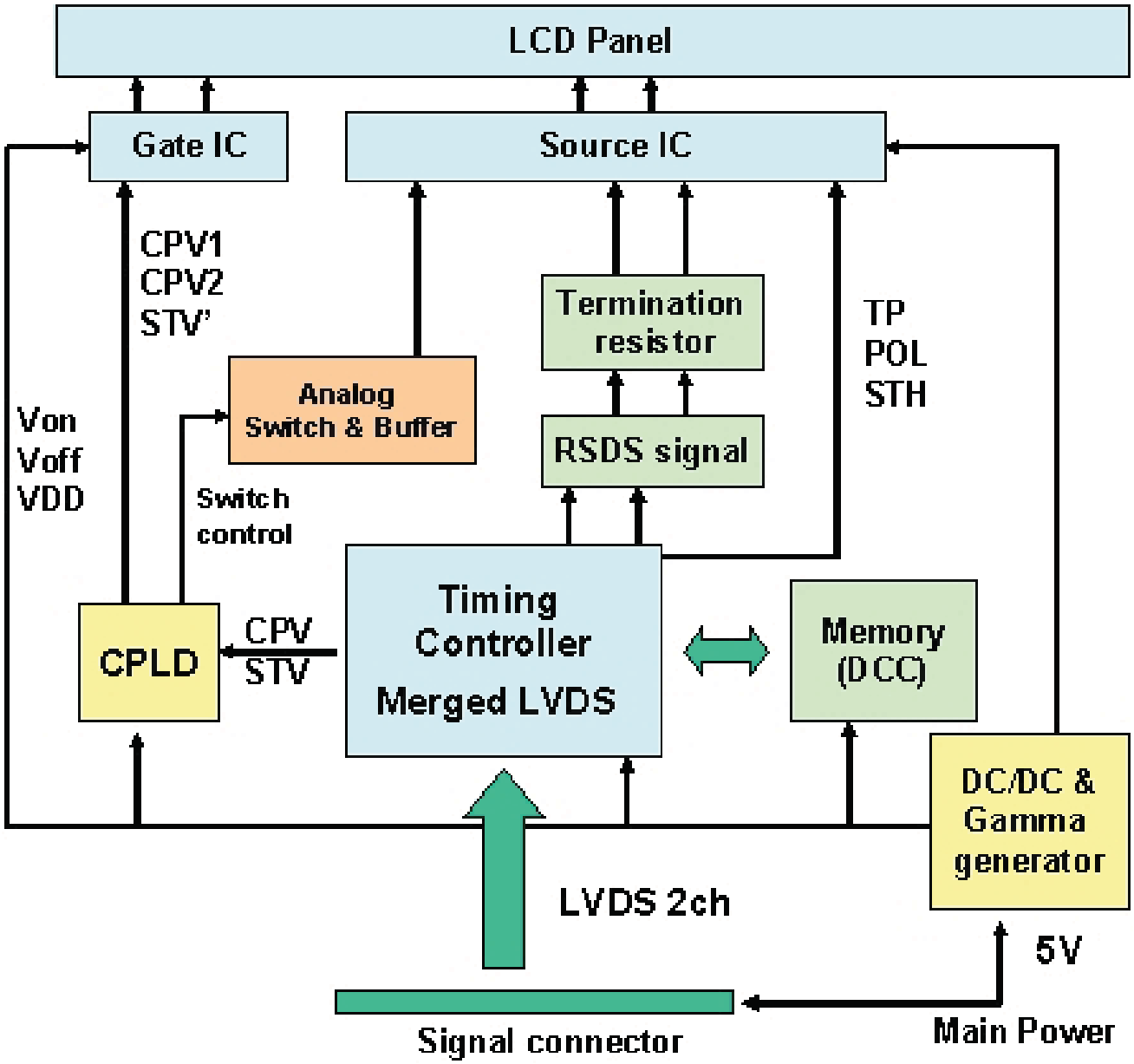
Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Input Voltage	Vin	-	21.6	24	26.4	V	Ta=25±2 °C
Input Current	I_{RUSH}	Vin=24.0V Vdim=3.3V	-	-	8.5	A	Initial Turn-on
Lamp Current	I_O	Vdim=3.3 V	5.5	6.0	6.5	mArms	-
Frequency	F_{LAMP}	Vin=24.0 V	47.5	50	52.5	kHz	-
Backlight On/Off	ON	Vin=24.0 V	2.4	-	5.25	V	-
	OFF	Vin=24.0 V	0	-	0.8		
Dimming Control	V_{DIM}	Max Lum	3.3	-	-	V	-
		Min. Lum	-	-	0		

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4. Block Diagram



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5. Input Terminal Pin Assignment

5.1. Input Signal & Power

Connector : FI-RE51S-HF (JAE)

PIN No.	Description		PIN No.	Description	
1	VDD(5V)		26	Even LVDS Signal	RE[0]P
2	VDD(5V)		27		RE[1]N
3	VDD(5V)		28		RE[1]P
4	VDD(5V)		29		RE[2]N
5	VDD(5V)		30		RE[2]P
6	GND		31		GND
7	GND		32		RE[CLK]N
8	GND		33		RE[CLK]P
9	GND		34		GND
10	Odd LVDS Signal	RO[0]N	35		RE[3]N
11		RO[0]P	36		RE[3]P
12		RO[1]N	37	Do Not Connect	
13		RO[1]P	38	Do Not Connect	
14		RO[2]N	39	GND	
15		RO[2]P	40	Do Not Connect	
16		GND	41	Do Not Connect	
17		RO[CLK]N	42	Do Not Connect	
18		RO[CLK]P	43	Do Not Connect	
19		GND	44	Do Not Connect	
20		RO[3]N	45	LVDS Option(Note 2)	
21		RO[3]P	46	Do Not Connect	
22	Do Not Connect(Note 1)		47	Do Not Connect	
23	Do Not Connect		48	Do Not Connect	
24	GND		49	Do Not Connect	
25	Even LVDS	RE[0]N	50	Do Not Connect	
			51	Do Not Connect	

Note (1) Do Not Connect : This PINS are only used for SAMSUNG internal using.
Note (2) LVDS OPTION : If this PIN : HIGH (3.3 V) → Normal LVDS format
: LOW (GND) → JEIDA LVDS format
SEQUENCE : On = V_{DD}(T1) ≥ LVDS Option ≥ Interface Signal(T2)
OFF = Interface Signal(T3) ≥ LVDS Option ≥ V_{DD}

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Note(1) Pin number starts from Right side

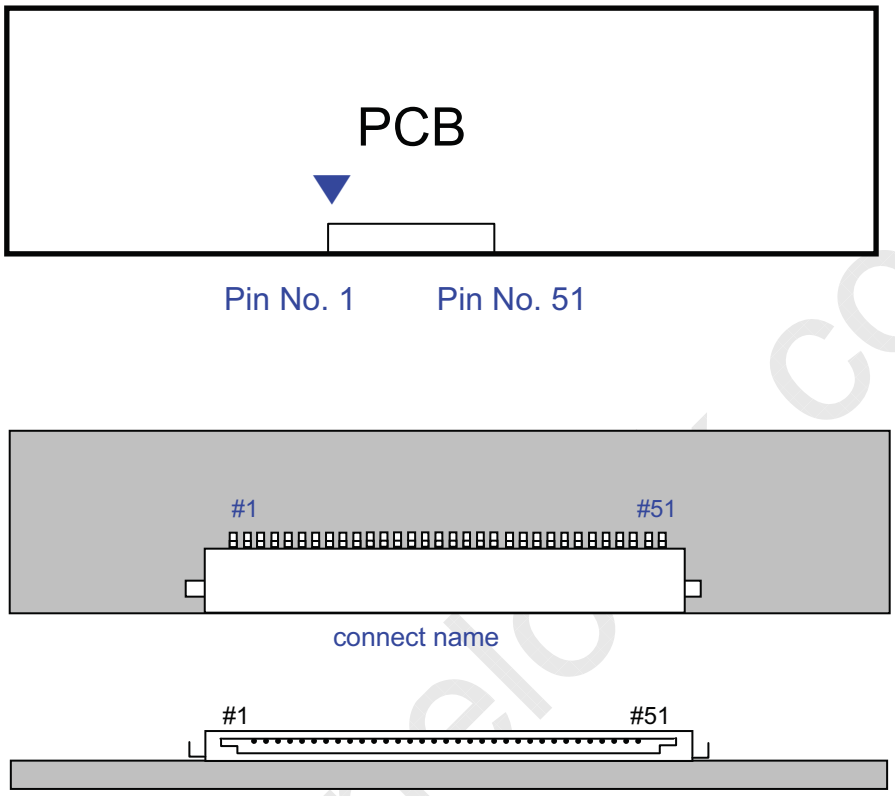


Fig. Connector diagram

a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pins should be separated from other signal or power.

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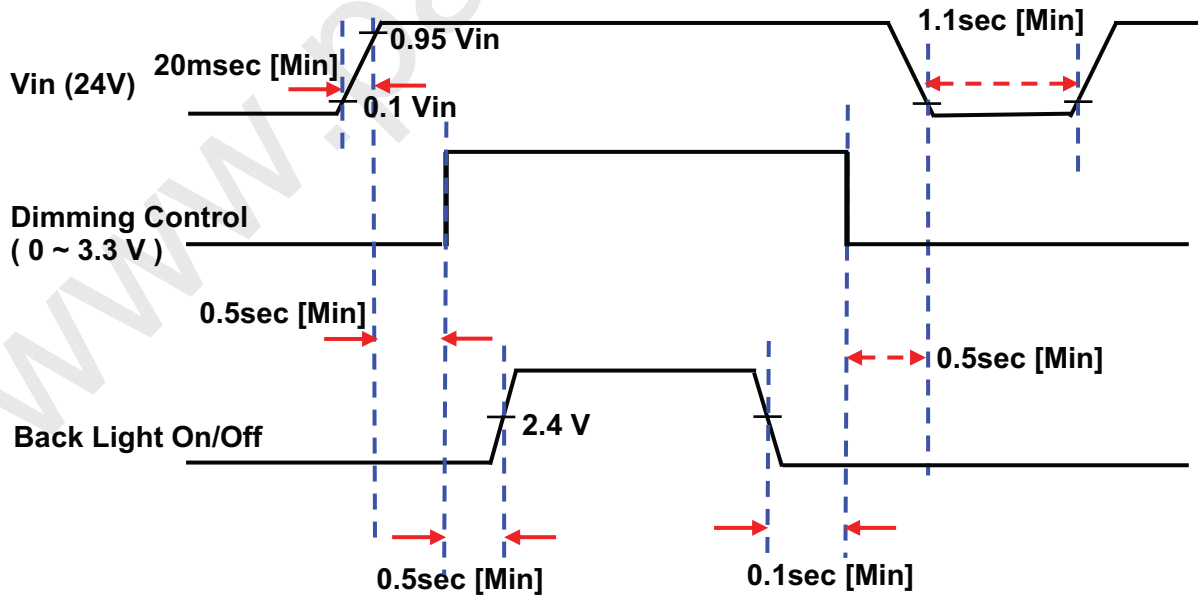
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5.2. Inverter Input Pin Configuration

Connector : S14B-PHA-SM (JST)

Pin No.	Pin Configuration(FUNCTION)
1	24 V
2	24 V
3	24 V
4	24 V
5	24 V
6	GND
7	GND
8	GND
9	GND
10	GND
11	No Connection * ERROR DETECTION (NORMAL : GND / ABNORMAL : 5V)
12	Backlight On /Off [ON:2.4 - 5.25 V, OFF: 0 - 0.8 V]
13	Dimming Control [0V:Min, 3.3V:Max]
14	No Connection

5.3. Inverter Input Power Sequence



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5.4 LVDS Interface

- LVDS Receiver : Tcon (merged)
- Data Format (JEIDA & Normal)

LVDS Transmitter (ex : ***DS90C385***) Signal Interface					
Device Input Pin	Device Input Signal		Output Signal	To LTA460H2 Interface	
Symbol	Symbol	Function		Terminal	Symbol
TXIN0	R0	Red Pixel Data (LSB)	TXOUT0- TXOUT0+	No. 1,11 No. 2,12	RX0- RX0+
TXIN1	R1	Red Pixel Data			
TXIN2	R2	Red Pixel Data			
TXIN3	R3	Red Pixel Data			
TXIN4	R4	Red Pixel Data			
TXIN5	R7	Red Pixel Data (MSB)	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN6	R5	Red Pixel Data	TXOUT0- TXOUT0+	No. 1,11 No. 2,12	RX0- RX0+
TXIN7	G0	Green Pixel Data (LSB)			
TXIN8	G1	Green Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN9	G2	Green Pixel Data			
TXIN10	G6	Green Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN11	G7	Green Pixel Data (MSB)			
TXIN12	G3	Green Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN13	G4	Green Pixel Data			
TXIN14	G5	Green Pixel Data			
TXIN15	B0	Blue Pixel Data (LSB)			
TXIN16	B6	Blue Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+
TXIN17	B7	Blue Pixel Data (MSB)			
TXIN18	B1	Blue Pixel Data	TXOUT1- TXOUT1+	No. 3, 13 No. 4, 14	RX1- RX1+
TXIN19	B2	Blue Pixel Data	TXOUT2- TXOUT2+	No. 5, 15 No. 6, 16	RX2- RX2+
TXIN20	B3	Blue Pixel Data			
TXIN21	B4	Blue Pixel Data			
TXIN22	B5	Blue Pixel Data			
TXIN24	Hsync	Horizontal Sync (Don't care)			
TXIN25	Vsync	Vertical Sync (Don't care)			
TXIN26	DE	Data Enable (Mandatory)			
TXIN27	R6	Red Pixel Data	TXOUT3- TXOUT3+	No. 9,19 No. 10,20	RX3- RX3+

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5.5 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	DATA SIGNAL																								GRAY SCALE LEVEL
		RED								GREEN								BLUE								
		R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~ R252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R252
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~ G252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G252
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~ B252
	↓ LIGHT	:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B252
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B252
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B252

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

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6. Interface Timing

6.1 Timing Parameters (DE only mode)

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	60	74.25	80	MHz	-
Hsync		F_H	48	67.5	-	KHz	-
Vsync		F_V	-	60	-	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	-	1080	-	Lines	-
	Vertical Total	T_{VB}	1118	1125	1550	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	-	1920	-	Clocks	-
	Horizontal Total	T_H	2160	2200	3500	clocks	-

Note) This product is DE only mode. The input of Hsync & Vsync signal does not have an effect on normal operation.

(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system

(2) Internal V_{DD} = 3.3V

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Note(1) Pin number starts from Right side

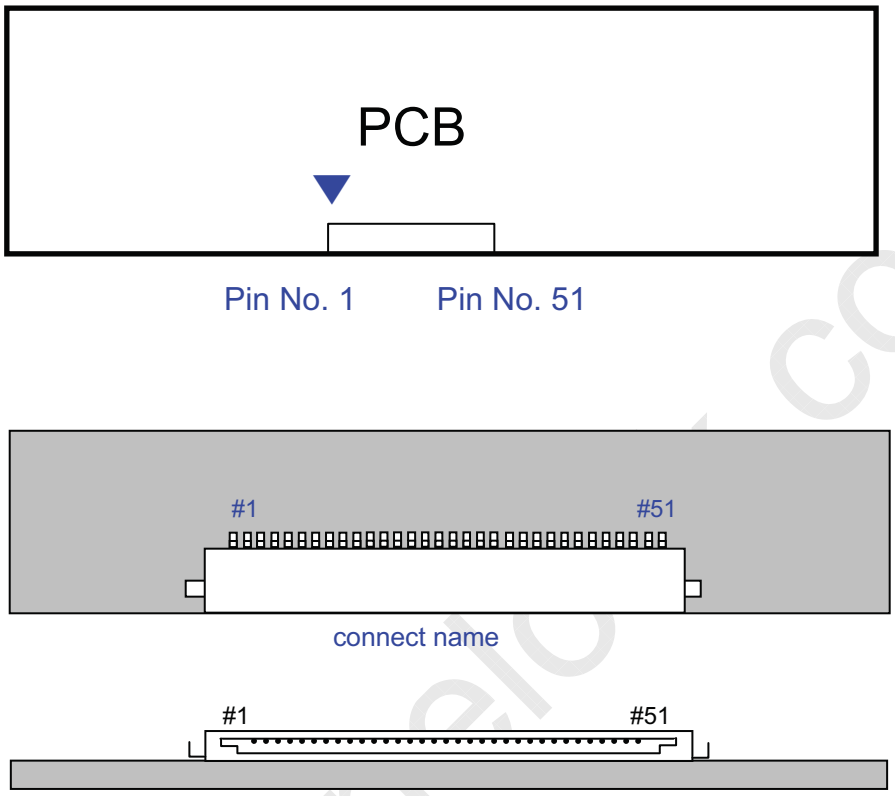


Fig. Connector diagram

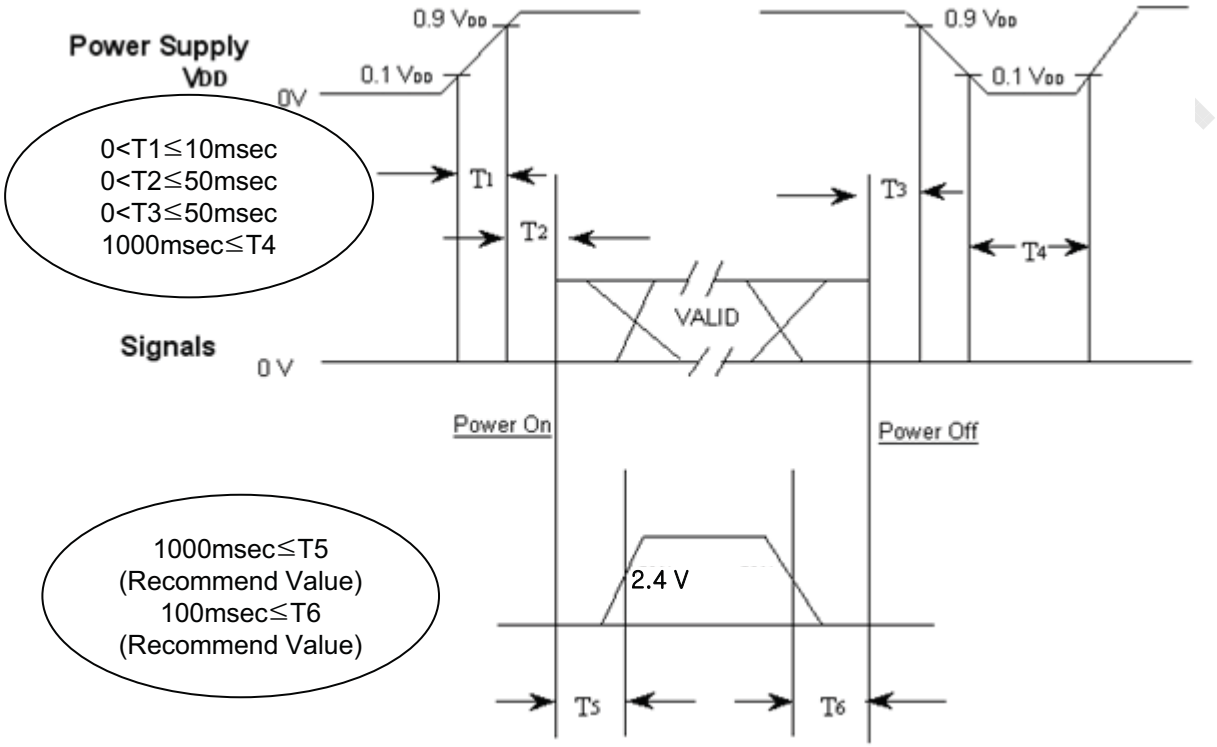
a. All GND pins should be connected together and also be connected to the LCD's metal chassis.
b. All power input pins should be connected together.
c. All NC pins should be separated from other signal or power.

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6.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.



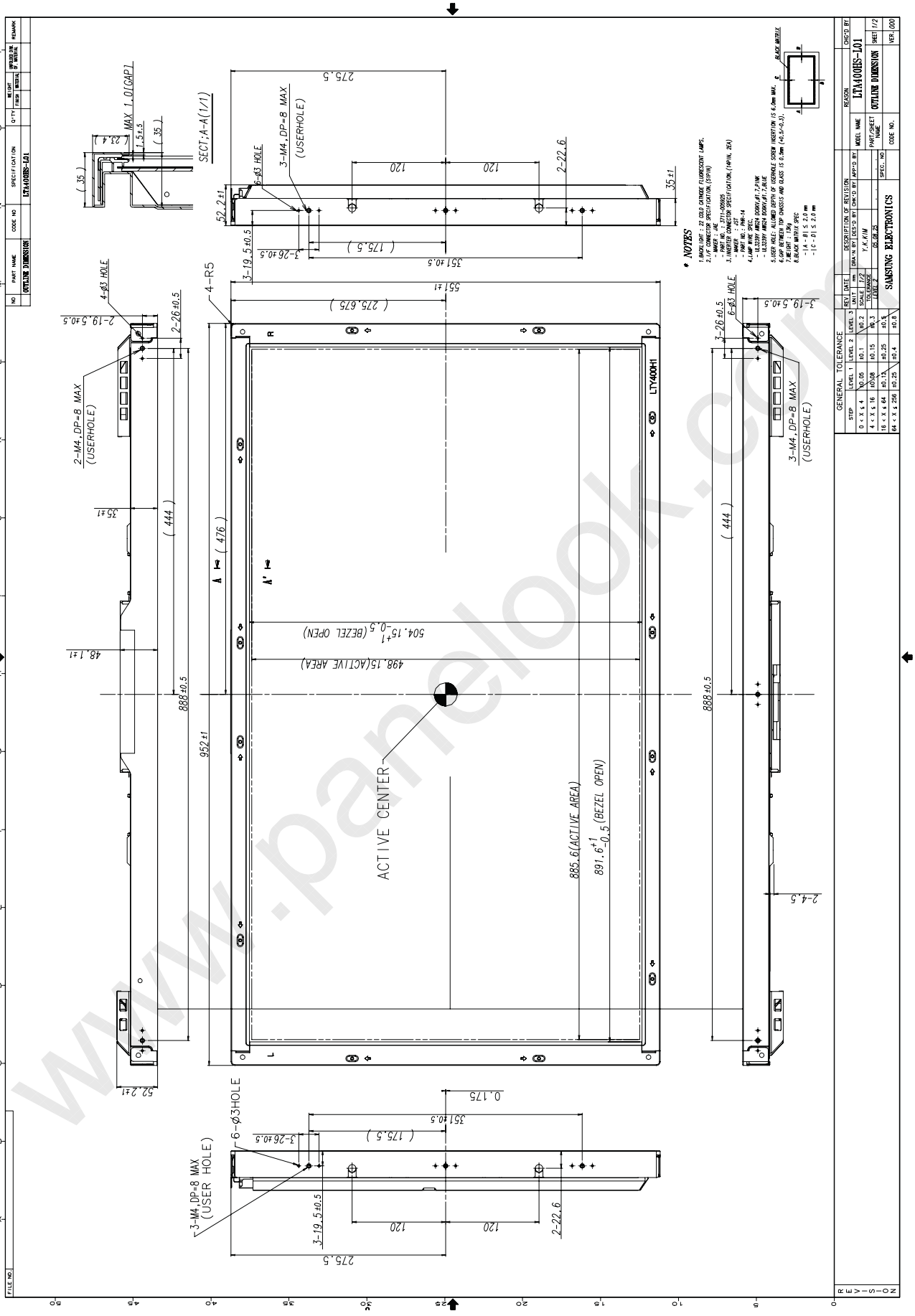
T1 : V_{DD} rising time from 10% to 90%
T2 : The time from V_{DD} to valid data at power ON.
T3 : The time from valid data off to V_{DD} off at power Off.
T4 : V_{DD} off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V_{DD} = off level, please keep the level of input signals low or keep a high impedance.
- T4 should be measured after the Module has been fully discharged between power off and on period.
- Interface signal should not be kept at high impedance when the power is on.

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7. Outline Dimension (Front View)



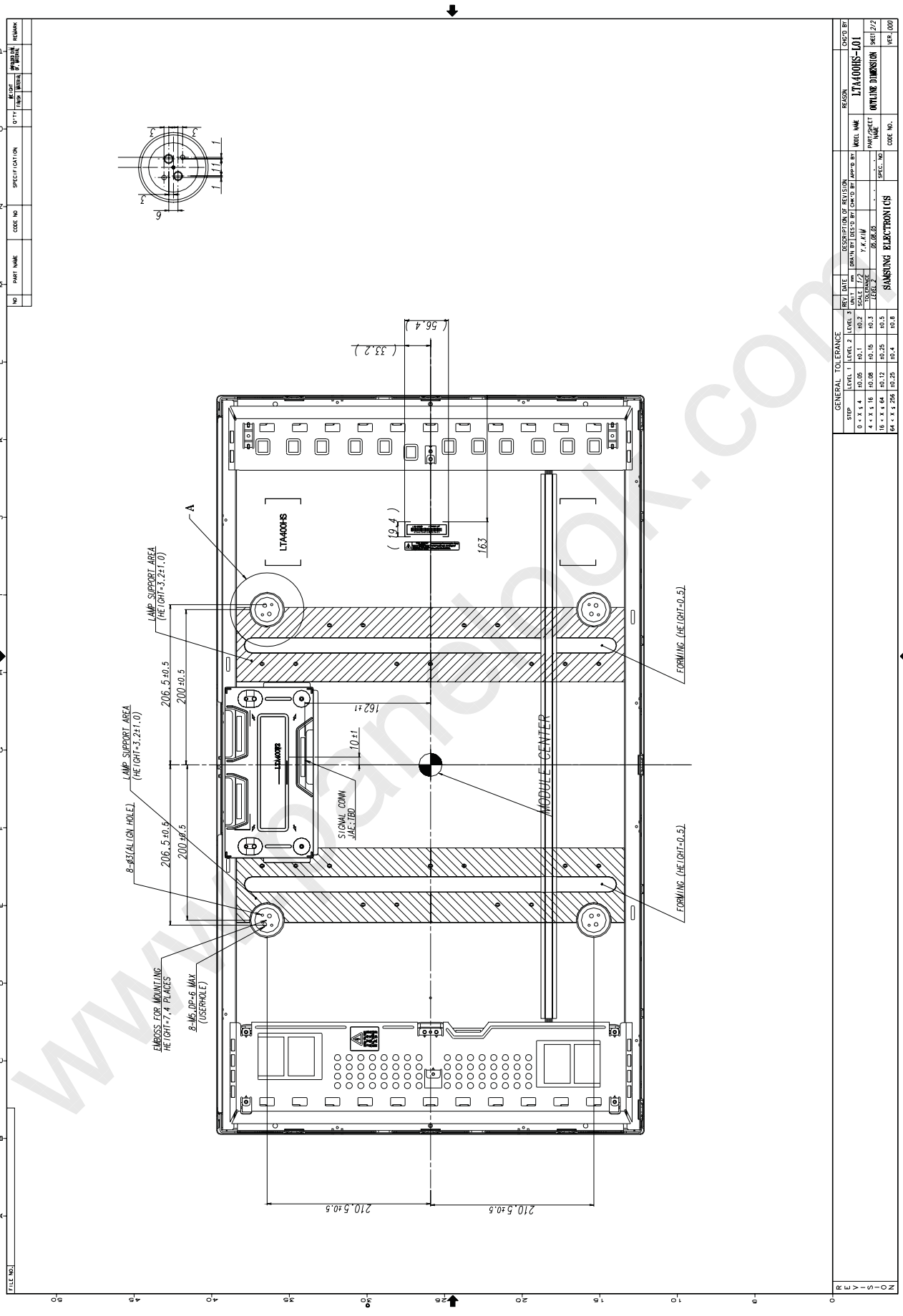
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Model	Doc. No	Page
LTA400HS-L01	05-000-G-051122	22 / 29

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7. Outline Dimension (Rear View)



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Model	LTA400HS-L01	Doc. No	05-000-G-051122	Page	23 / 29

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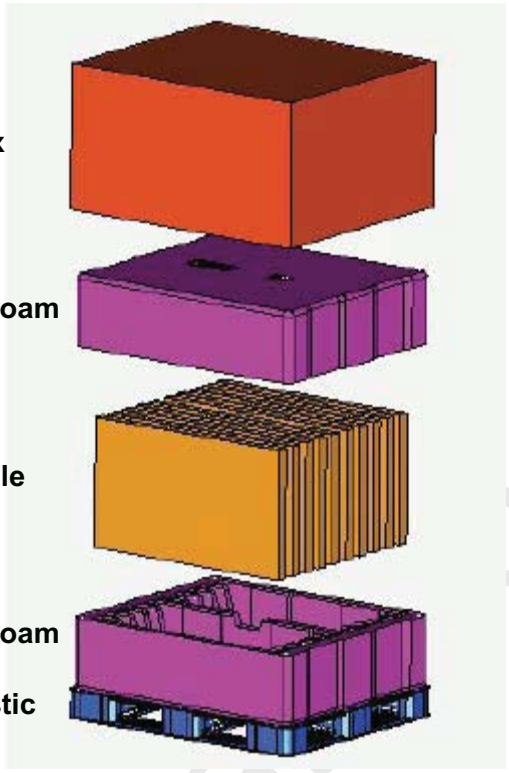
8. PACKING

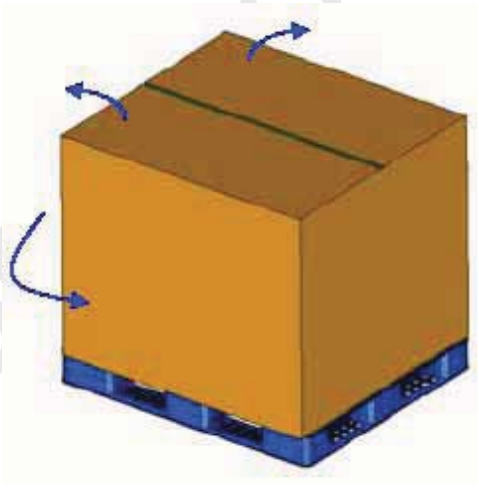
8.1 CARTON (Internal Package)

(1) Packing Form

Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method





8.2 Packing Specification

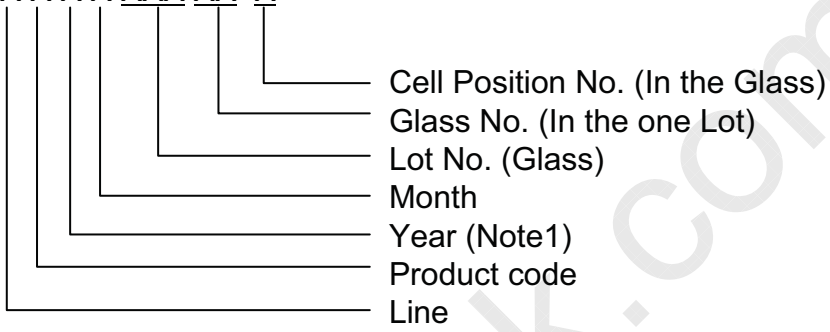
Item	Specification	Remark
LCD Packing	10ea / (Packing-Pallet Box)	1. 125 Kg / LCD (10ea) 2. 7 Kg / Cushion-pallet (2ea) 3. 6.7 Kg / Packing-Pallet Box (1ea) 4. Cushion-pallet Material : EPS 5. Packing-Pallet Box Material : DW4
Pallet	1Box / Pallet	1. Pallet weight = 8kg 2. 8Kg/Pallet
Packing Direction	Vertical	
Total Pallet Size	H x V x height	1270mm(H) x 1150mm(V) x 844mm(height)
Total Pallet Weight	146.7kg	Pallet(8kg) + Module(12.5*10=125) + Cushion(up+botton=7kg) + Pallet-BOX(6.7kg)

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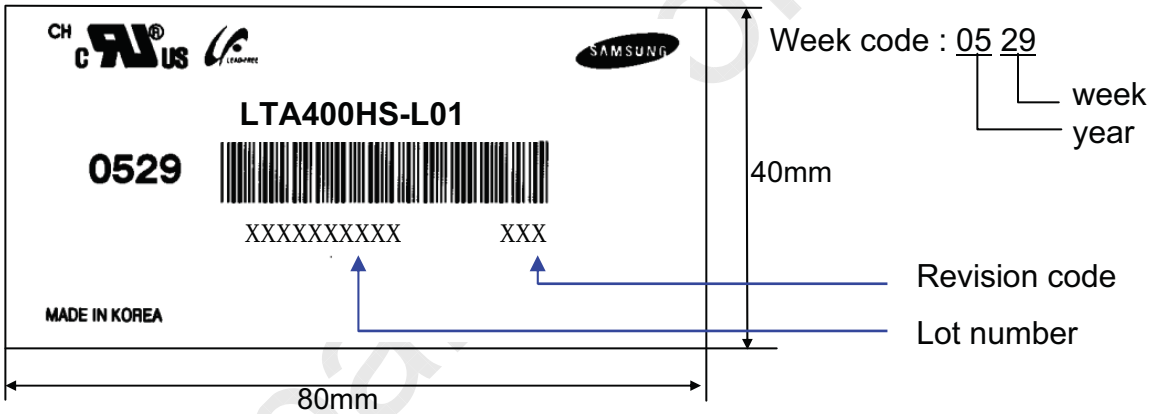
9. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

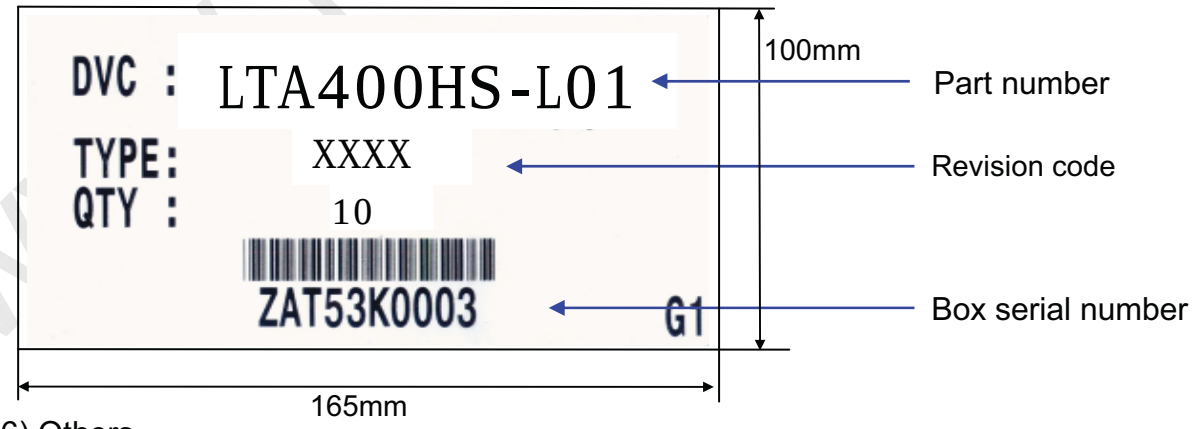
(1) Parts number : LTA400HS-L01-XXXX
(2) Revision: One letters
(3) Lot number : X X X X XXX XX X



(4) Nameplate Indication



(5) Packing box attach



(6) Others

1. After service part
   Lamps cannot be replaced because of the narrow bezel structure.

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10. Inspection Criteria

When products are shipped, incoming inspection should be carried out with a sampling inspection based on MIL-STD-105E level II by AQL 1.0%.

CHANGE CONTROL

Design of the product may be changed regarding the specifications, appearance, parts used, circuits, etc. for product improvement. If a design change is judged to affect the specifications of this product, supplier should inform customer of the change in advance.

QUALITY CONTROL

In the event of a product failure under normal operating conditions, a product trouble or a functional disorder that can be deemed to be the responsibility of supplier, supplier should repair the fault or replace the product free of charge within one year from the product delivery date. However, supplier does not take responsibility for the product quality in the case of modifications not specified by supplier.

MAINTENANCE

The specifications of the functions of maintenance parts may be partially changed within the range which provides equivalent or better quality.
In principle, maintenance parts should be product units.
When stopping manufacturing this product, supplier should notify customer in advance.

HANDLING OF DOUBTFUL POINTS

Any doubt not stipulated in this specification is to be resolved by mutual agreement between customer and supplier, and supplier should make efforts for improvement in good faith.

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11. General Precautions

11.1 Handling

(a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.

(b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.

(c) Refrain from strong mechanical shock and / or any force to the Module. In addition to damage, this may cause improper operation or damage to the Module and CCFT back light.

(d) Note that polarizers are very fragile and could be damage easily. Do not press or scratch the surface harder than a HB pencil lead.

(e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.

(i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.

(j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(k) Do not disassemble the Module.

(l) Do not pull or fold the lamp wire.

(m) Do not adjust the variable resistor located on the Module.

(n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

(o) Pins of I/F connector should not be touched directly with bare hands.

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11.2 Storage

(a) Do not leave the Module in high temperature, and high humidity for a long time. It is highly recommended to store the Module with temperature from 0 to 35℃ and relative humidity of less than 70%.

(b) Do not store the TFT-LCD Module in direct sunlight.

(c) The Module should be stored in a dark place. It is prohibited to apply sunlight or fluorescent light in storing.

11.3 Operation

(a) No Connection or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference should be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should be connected directly with a minimized length. A longer cable between the back light and the inverter may cause lower luminance of lamp(CCFT) and may require higher startup voltage(Vs).

11.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 55±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature, humidity, display patterns or operation time etc.., It is strongly recommended to contact SEC for Application engineering advice. Otherwise, its reliability and function may not be guaranteed. Extreme conditions are commonly found at Airports, Transit Stations, Banks, Stock market, and Controlling systems.

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11.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

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